

# The tadpole of *Quasipaa fasciculispina* (Inger, 1970) from southeastern Thailand, with the description of its buccal anatomy

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We provide a description of the larva of *Quasipaa fasciculispina* (Inger, 1970) from the type locality: Khao Soi Dao Wildlife Sanctuary, Chanthaburi Province, Thailand. The buccal features are also described. This tadpole is compared to the other known tadpoles of the genus *Quasipaa* Dubois, 1992. It differs from them by the following combination of characters: tadpole of large size, the largest after *Q. verrucospinosa* (Bourret, 1937); KRF 2:5+5/1+1:2; three rows of papillae on the lower labium; and numerous black spots on the tail without a transverse bar between tail and body. This tadpole is used for consumption by local people.

## INTRODUCTION

*Quasipaa fasciculispina* was described from southeastern Thailand by INGER (1970) as *Rana fasciculispina*. The genetic placement of this species changed several times (DU BOIS, 1987, 1992, JIANG et al., 2005, FROST et al., 2006) and we here follow OHLER & DUBOIS (2006) in considering it as a member of the genus *Quasipaa* Dubois, 1992. This species is currently known from southeastern Thailand (Chanthaburi Province) and southwestern Cambodia (INGER, 1970, KHONSUE & THIRAKHUPI, 2001; BRINGSOI, 2002, LAUHAICHINDA et al., 2002, NOIKOIR & LAUHAICHINDA, 2002, OHLER et al., 2002; NABHITABHATA et al., 2004, OHLER & DUBOIS, 2006, STUART & EMMETT, 2006, GRISMER et al., 2007). In Thailand, even though this

species has been known for more than 38 years by science and for a long time by local people who collected this frog and its tadpoles for consumption, the knowledge on this species is poor. At present, this species has been listed as Vulnerable in the Thai Red List (NABHITABHATA & CHAN-ARD, 2005) and is also listed as a Protected Animal of Thailand by the Thai law.

Tadpoles of *Quasipaa fasciculispina* were reared by the first author and described in her master degree (INTHARA, 2000). Then INTHARA et al. (2005) provided information on distribution, a drawing of the oral disc and a life photo (in lateral view) of the tadpole of *Q. fasciculispina*. Recently, we obtained a few tadpole specimens from the type locality of *Q. fasciculispina*. We describe here their external morphology and their buccopharyngeal anatomy, and give illustrations of the tadpole of this species.

## MATERIALS AND METHODS

Two tadpoles were captured in the type locality of *Quasipaa fasciculispina* (Khao Soi Dao Wildlife Sanctuary, Chanthaburi Province, Thailand) by hand at night and preserved in a mixed solution of 10% formalin and 70% ethanol with a ratio of 50:50. The specimens were deposited at the Thailand Natural History Museum (THNHM), Pathum Thani, Thailand, and were loaned for study to the Muséum national d'Histoire naturelle (MNHN), Paris, France.

The tadpoles correspond in external morphology, oral disc and keratodont row formula to the specimen shown and described by INTHARA (2000). Our identification matches the identification of local people who recognize this tadpole as belonging to *Quasipaa fasciculispina*. This taxon is also the only species of the tribe Panni (DUBOIS, 1992; ÖHLER & DUBOIS, 2006) known from southeastern Thailand. For all these reasons, we assigned these tadpoles to *Quasipaa fasciculispina*.

The illustrations of the larva, oral disc and buccal anatomy were made using a Leica MS5 stereomicroscope with the help of a camera lucida. Morphological terminology follows ALTIG & McDIARMID (1999), whereas keratodont row formula is given according to DUBOIS (1995). Developmental stages follow GOSNER (1960). Measurements were made with a graduated ocular attached to a stereomicroscope except for TL which was measured with a digital caliper to the nearest 0.1 mm. The landmarks are those shown in ALTIG & McDIARMID (1999: 26, figure 3 I), and the additional ones used by GROSJEAN (2006). The abbreviations used are: A2R, length of the second keratodont row on the upper labium; BH, maximum height of body; BL, body length; BW, maximum width of body; DG, length of the dorsal papilla gap; ED, maximum diameter of eye; KRF, keratodont row formula; LF, maximum height of lower tail fin; MTH, maximum tail height; NN, internarial distance; NP, nariopupilar distance; ODW, oral disc width; PP, interpupilar distance; RN, rostro-narial distance; SS, distance from tip of snout to opening of spiracle; SU, distance from tip of snout to insertion of upper tail fin; SVL, snout-vent length; TAL, tail length (distance from opening of vent to tip of tail); TL, total length; TMH, maximum height of tail muscle; TMW, maximum width of tail muscle; UF, maximum height of upper tail fin.

## RESULTS

**Quasipaa fasciculispina** (Inger, 1970)

(fig. 1-2)

*Material examined* THNHM 13108.1-2 (field numbers Y 0862.1-2, stages 37 and 28 respectively) from Khao Soi Dao Wildlife Sanctuary, Chanthaburi Province, Thailand. Collected on 7 August 2006 by Y. Chuaynkern. Raw measurements of the two specimens examined are given in table 1.

*Larval diagnosis.* Large tadpole, body stout, oval, tail fin with black spots but without a transverse bar between tail and body; beak undivided, outer surface of lower beak smooth, upper beak dimpled on the middle; KRF 2.5+5/1+1.2, three rows of papillae on the lower labium.

*Larval description* Based on the specimen THNHM 13108 2, stage 28, TL 77.7 mm, BL 23.9 mm. Body in lateral view (fig. 1a) oval (quite obtuse), snout nearly rounded, in dorsal view (fig. 1b) body elliptical, snout semicircular, BW 120% of BH. Eyes of moderate size, ED 9.7% of BL, bulging and not visible in ventral view, positioned and directed dorsolaterally. Nares round, of small size, rimmed, positioned and directed anterolaterally, closer to tip of snout than to pupils, RN 64% of NP, NN 60% of PP. Spiracle single, sinistral, square, of small size, at mid-distance between snout and anal tube opening; in ventrolateral position, oriented posterodorsally, free from body over most of its length; SS 48% of BL, opening in a plane which would go through a zone comprised between beginning of caudal myotomes and hind limbs. Tail musculature strong, TMH 71% of BH and 59% of MTH, gradually tapering and almost reaching tail tip. Tail fins of moderate size; UF 32% of MTH, LF 27% of MTH; upper fin not extending onto body, SU 83% of BL, slightly convex, lower fin not extending onto body, convex, MTH 121% of BH, tail tip subelliptical with slight point. Anal tube (fig. 1c) of approximately conical shape, medial and entirely attached to ventral fin, opening on lateral right side, posteriorly directed. Oral disc (fig. 2) positioned and directed anteroventrally, emarginated, of large size, ODW 31% of BL and 55% of BW, elliptical with a median notch on the lower labium. A row of papillae at the lateral sides of upper labium, 13 submarginal papillae, 3 papilla rows on lower labium. No denticulate papillae. One large papilla gap on the upper labium, no gap on the lower labium, DG 59% of ODW. KRF 2:5+5/1+1.2, rows of upper labium subequal, A3 with a short gap, lower rows subequal. Jaw sheaths moderately sized, black in color with fine serrations; upper sheath reverse V-shaped with its median part dimpled, lower sheath V-shaped (quite wide). Pineal ocellus present at the level of anterior edge of eyes. Lateral line present. 1<sup>st</sup> lateral line beginning at margin of mouth, continuing above nares and eyes then curving ventrally and finishing at margin of snout, 2<sup>nd</sup> line continuing from eyes along side of body until tail, 3<sup>rd</sup> line beginning from snout, continuing above spiracle and reaching tail.

*Coloration* *In preservative* Body creamy with dark pigmentation, ventral side gray, tail creamy white with numerous black spots, getting denser in posterior part of tail, posterior

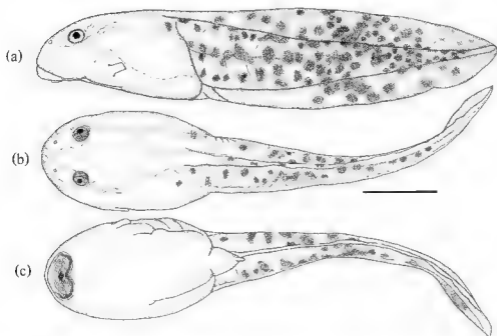


Fig. 1 Drawing of a tadpole of *Quasipaa fusciculypina* (Inger, 1970) (based upon THNHM 13108 2, Gosner's stage 28) (a) lateral, (b) dorsal and (c) ventral views. Scale bar: 10 mm

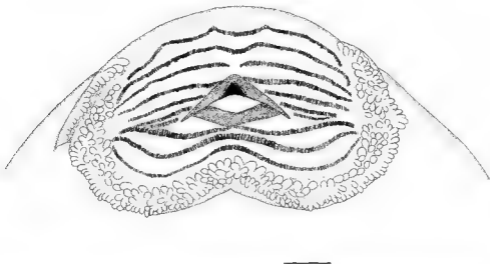


Fig. 2 Oral disc of *Quasipaa fusciculypina* (Inger, 1970) (based upon THNHM 13108 2, Gosner's stage 28) Scale bar: 1 mm

Table 1 Measurements (in millimetres) of tadpoles of *Quasipaa fasciculispina* (Inger, 1970) The tip of the tail of the specimen in stage 37 is damaged, hence a shorter total length and tail length Abbreviations are given in the *Material and methods* section.

Measurement characters	THMHN 13108 1, stage 37	THMHN 13108 2, stage 28	Measurement characters	THMHN 13108.1, stage 37	THMHN 13108.2, stage 28
TL	71.88	77.67	ED	2.47	2.32
BL	23.97	23.91	TAL	40.60	47.04
SVL	31.28	31.28	UF	4.64	4.35
SS	13.49	11.46	LF	3.77	3.63
SU	21.34	19.79	MTH	14.22	13.49
BH	11.90	11.17	TMH	7.98	7.98
BW	14.22	13.35	TMW	6.96	6.96
PP	7.54	7.11	ODW	7.38	7.38
NN	4.35	4.24	DG	4.35	4.35
RN	2.61	2.32	A2R	4.91	5.28
NP	3.77	3.63	KRF	2.5+5.1+1.1	2.5+5.1+1.1

part of tail dark (see fig. 1) *In life*. Body brown with dark dots, tail creamy brown with numerous black spots.

*Buccal description* Based on the specimen THNHM 13108 1, stage 37

*Roof* (fig. 3). *Prenarial arena* with high medial ridge, top of ridge smooth, side with 3-5 short papillae. *Choanae* narrow, slightly oblique, internarial distance about 1/5 length of choanae, anterior wall pustular, no papilla on the narial valve. *Postnarial arena* with large postnarial papillae with 4-5 short branches, extremity of each branch curved down, top of postnarial papillae wide, with pustules arranged in 4 rows, 4 short pustulose papillae directed anteromedially lying anterior to median ridge, 1<sup>st</sup> papilla very short and the other arranged in pairs. Median ridge triangular, much wider than long, jagged. *Lateral ridge papilla* with 4-5 deep branches, each branch with pustules, some branches bifurcate. *Buccal roof arena* oval, wider posteriorly than anteriorly, one long buccal roof arena papilla curved down on each side posterior to lateral ridge, interior of arena with numerous both short and long papillae, highest papilla on each lateral border, most of lateral roof papillae directed medially, posterior part with melanic pigments, 16 short papillae anteriorly to esophageal funnel. *Posterolateral ridge* formed of moderately high and numerous papillae. No glandular zone. *Dorsal velum* discontinuous, margin curved, medial portion curving towards esophagus.

*Floor* (fig. 4). *Prelingual arena* square, its floor smooth except the presence of a low ridge anterior to tongue anlage bearing two pairs of small papillae. Three pairs of infra-labial papillae, the most anterior pair short with 6-8 pustules, the second pair long with 10-12 pustules, and the third pair on the posterolateral corner of the arena. Infra-labial papillae of the third pair as very large palmate projections of butterfly wing shape (continuous with the anterior infra-labial papillae), these palmate projections bearing numerous pustules and short papillae, anterior end of palmate projection attached to posterolateral part of prelingual



Fig. 3. Buccal roof of *Quasipaa fasciculispina* (based upon THNHM 13108.2, Gosner's stage 28): (a) general view; (b) anterior part. Scale bar, 1 mm.

rena, posterior end of palmate projection folded down and freely moveable. Both palmate projections having the possibility to get in contact with each other if posterior part expanded, but normally each palmate projection bended down so forming a large gap between them. *Tongue anlage* elliptically shaped (almost round), bearing 4 papillae, a medial and a lateral pair, medial pair long, with 3-6 small pustules on both sides (anteriorly more numerous than posteriorly), lateral pair shorter, with pustules. *Buccal floor arena* about as wide as long, anterior part with only 10 papillae inside the arena, each bearing 2-3 branches, medial and posterior part (corresponding to about 3/4 of buccal floor length) covered with numerous short and long papillae and some pustules, the posterolateral parts of floor with densely set papillae, anteromedially to buccal pockets with 3 large papillae on each side with pustulose extremities. Anterior to buccal pockets presence of a bunch of short and long papillae. *Buccal pockets* elliptical, transverse, distance to tongue anlage shorter than to medial end of ventral elum. *Ventral elum* continuous, with spicular support, highly wavy, margin with 25 projections forming a median notch medially. *Glottis* small. *Branchial baskets* oblique, longer than wide, 3 filter plates on each side, length of the second filter plate about 1/2 length of floor arena.

*Natural history notes.* These tadpoles were captured at night by hand in a small stream. They were seen remaining motionless near the water surface. When the collector came close, they immediately dived down to the bottom and hid under a rock (approximately 30 cm large). The tadpoles were caught by moving hands slowly under the rock. At night male frogs of *Quasipaa fasciculispina* were calling sitting on the rocks. Several males and females were captured by

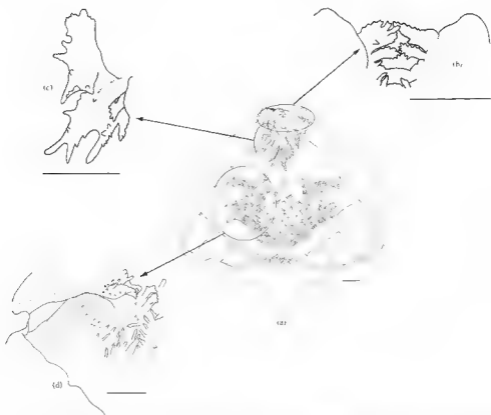


Fig 4 Buccal floor of *Quasipaa fasciculispina* (based upon THNHM 13108 2, Gosner's stage 28) (a) general view, (b) anterior infralabial papillae, (c) posterolateral infralabial papillae, (d) buccal pocket area. Scale bar 1 mm.

hand to observe external morphology and then released. In the same stream, only a few tadpoles of *Xenophrys* sp. were found. They probably belonged in *Xenophrys lekaguli* which was described from this locality by SITI ARI et al. (2006), although other species of *Xenophrys*, such as *Xenophrys australensis*, could occur in this region of Thailand. Several calls of *Phyllautus* sp. were heard along the stream banks.

## DISCUSSION

OHLER & DUBOIS (2006) studied the phylogenetic relationships and the generic taxonomy of the tribe PAMA and recognized six genera: *Allopaia* Ohler & Dubois, 2006, *Chapanana* Bourret, 1939, *Chrysopaa* Ohler & Dubois, 2006, *Gynandropaa* Dubois, 1992, *Nanomana*

Table 2. Diagnosis, size, KRF and bibliographic references in larvae of the genus *Quasipaa* Dubois, 1902. Data about the tadpoles of *Q. courtouisi*, *Q. julongensis*, *Q. tibetana* and *Q. yeti* are missing as these tadpoles are not known.

Species	Gosner's stage	Total size (mm)	SVL (mm)	Larval diagnosis	KRF	References
<i>Q. boulengeri</i>	36-38	49.2-55.1	17.8- 9.5	Dorsum yellow-brown or light brown, tan light coloured with dark dots, a black transverse stripe between body and tail; tail end bluntly pointed; lower labial papillae in two rows	1+1+1+4+1+1+1	LIU, 1940 LI & HU, 1961 WU et al., 1988 YANG, 1991; YE et al., 1993; FEI, 1999 HU & YE, 2001
<i>Q. exilispinosa</i>	28-36	54.1-60.9	18.2-20.5	Body pale yellow, tail with dark spots, tail end bluntly rounded, lower labial papillae in two rows	1+3+1+1+2	ANONYMOUS, 1975, Fei, 1999
<i>Q. fasciculispina</i>	28, 37	74.7-77.7	40.6, 31.1	Large tadpole, body brown with dark spots, and creamy brown with numerous black spots; tail tip subequal to body with slight point, lower labial papillae in three rows	2+5+1+1+1	INTHARA et al., 2005 this study
<i>Q. robertingeri</i>	not given	53	21	Dorsum brown yellow, tail light yellow or yellow, without spots, a brown transverse stripe between body and tail, no upper labial papillae; lower labial papillae arranged in two rows	1+4+1+1+2	FEI & YE, 2001
<i>Q. shui</i>	36-38	57.0-72.7	22.0-25.2	Body olive, 3-4 dark spots dorsolaterally on tail, anterior, tail end bluntly pointed, lower labial papillae in two rows	1+2(4+4)-(5+5)+1+1-2	LIU & HU, 1962 WU et al., 1988 YE et al., 1993, Fei, 1999
<i>Q. spinosa</i>	34-35	53.9-66.0	18.3-22.9	Body black gray middle of back light coloured; tail with spots, tail end bluntly rounded; lower labial papillae in two rows	2+3+1+4+1+1+1	BOURRET, 1947 WU et al., 1988 YANG, 1991 YE et al., 1993 Fei, 1999
<i>Q. verrucospinosa</i>	27-29	71.1-75.4	-	Large tadpole, dorsum black brown greenish, tail heavily spotted; lower labial papillae in three rows	1+5+3+1+1-2, 2+4+4+1+1-2	BOURRET, 1942 INGER et al., 1999

Gunther, 1896, and *Quasipaa* Dubois, 1902. *Quasipaa* comprises at present 11 species: *Quasipaa boulengeri* (Gunther, 1889); *Q. courtouisi* (Angel, 1922); *Q. exilispinosa* (Liu & Hu, 1962); *Q. fasciculispina* (Inger, 1970); *Q. julongensis* (Huang & Liu, 1985); *Q. robertingeri* (Wu & Zhao, 1995); *Q. shui* (Ahl, 1930); *Q. spinosa* (David, 1875); *Q. tibetana* (Boulenger, 1917); *Q. verrucospinosa* (Bourret, 1937), and *Q. yeti* (Chen, Qu & Jiang, 2002). The tadpoles of most of these species are known (table 2), but not those of the recently described ones or those with taxonomic problems (i.e., *Q. courtouisi*, *Q. julongensis*, *Q. tibetana* and *Q. yeti*), or *Q. fasciculispina*.

The larva of *Q. fasciculispina* is a large tadpole with creamy body background shaded by dark pigmentation, gray ventral side and creamy white tail with numerous black spots, and a KRF 2+5+5/1+1-2. The tadpoles studied here are similar to those described by INTHARA et al. (2005). They resemble some other members of this genus which are usually of creamy or yellow-brown coloration with black spots on body and tail. However, they differ from all other known tadpoles of *Quasipaa* except *Q. verrucospinosa* by their large size: they are the second largest of the known tadpoles of *Quasipaa* with a total length of 71.9 mm and 77.7 mm and body length of 24.0 mm and 23.9 mm at Gosner's stage 28 and 37, respectively. They differ also from some of the other *Quasipaa* tadpoles by their KRF. Tadpoles of the genus *Quasipaa* have from seven to ten keratodont rows, on the upper labium this number varies more than on the lower labium which normally has just three rows. The tadpole of *Q. fasciculispina* differs from the tadpoles of *Q. boulengeri*, *Q. exilispinosa* and *Q. robertingeri* in having two undivided rows of keratodonts on the upper labium (vs. just one in the latter species) and in having more



divided rows (five vs. three or four) Some individuals of *Q. spinosa* have two undivided keratodonts rows on the upper labium but the number of divided rows in this species is lower than in *Q. fasciculispina* (three to four vs. five). *Quasipaa verrucospinosa* is the largest of the known tadpoles of the genus. Furthermore it can be distinguished of *Q. fasciculispinosa* by its lower keratodont row number on the upper labium (only six instead of seven in *Q. fasciculispina*) and four rows of papillae on the lower labium. The only species which can have a similar upper labium keratodont row number is *Quasipaa shini* (KRF 1.5+5/1+1 2, 2.5+5/1+1:1 or 2.4+4/1+1.1), but in this case the lower labium keratodont row number is only two. *Q. fasciculispina* is the only species of *Quasipaa* present in its area of distribution, no other *Quasipaa* species occurring in sympatry with it. The tadpoles of four species of *Quasipaa* are not yet known *Q. courtoisi*, *Q. julongensis*, *Q. tibetana* and *Q. yei* Total length, body length, KRF and a larval diagnosis of all known tadpoles of *Quasipaa* are summarized in table 2.

Although stated as closely related to *Q. verrucospinosa* in the original description (INGER, 1970), by its large size and its KRF the tadpole of *Q. fasciculispinosa* seems closer to that of *Q. shini*.

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